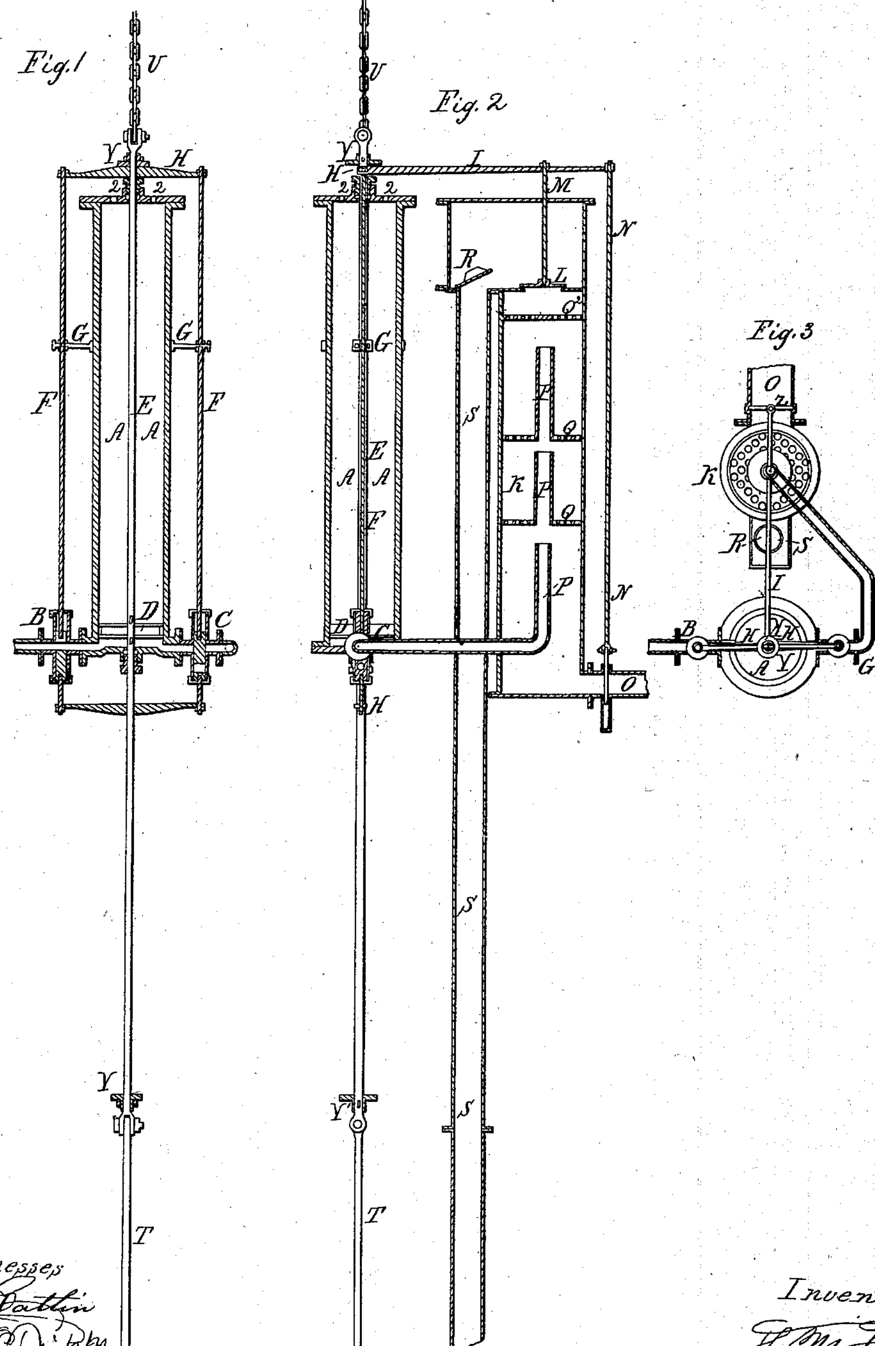
Sheet 1-3 Sheets.

T. M. Fell,

Pump Lift,

No. 47,289. Patented Apr. 18, 1865.

Fig. 1 Fig. 2 Fig. 3



Witnesses
C. F. Catlin
W. C. Dripps

Inventor
Thos. M. Fell

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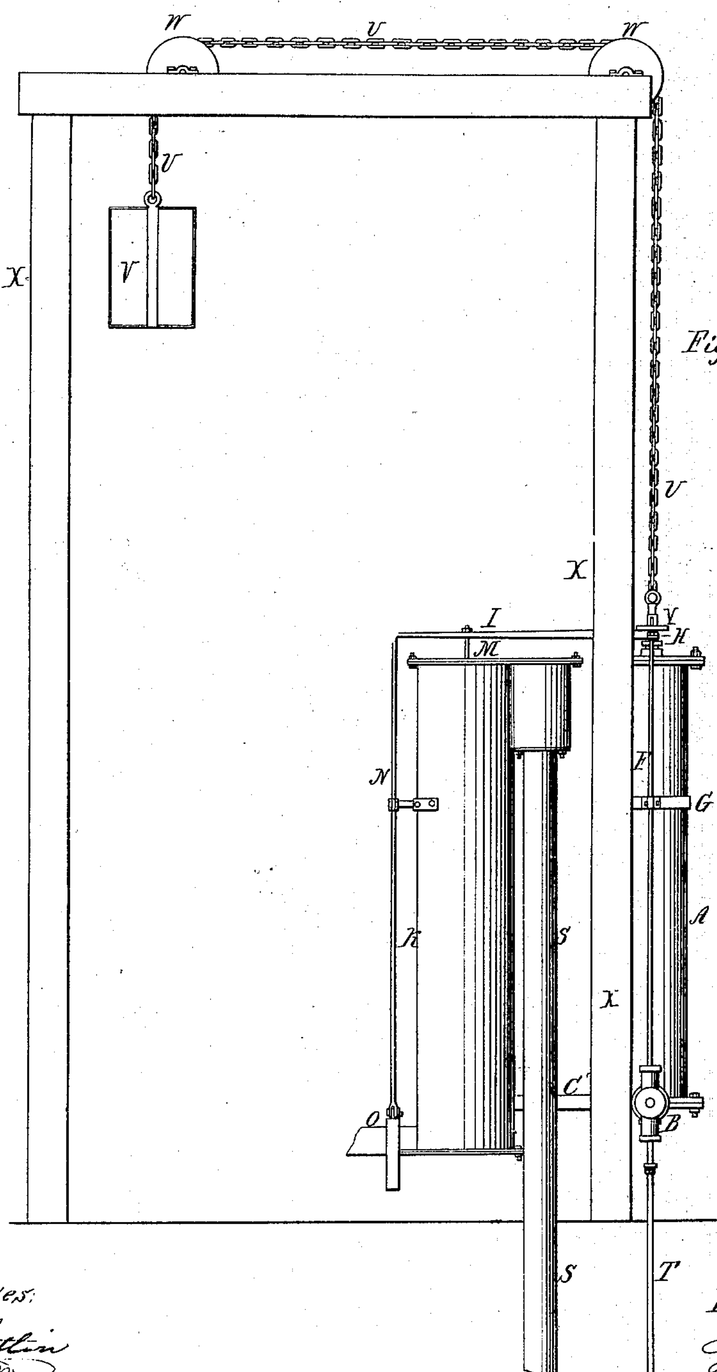

Witnesses:

Inventor

Sheet 3. 3 Sheets.

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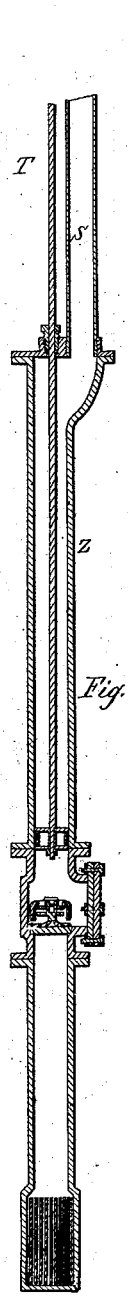


Fig. 5

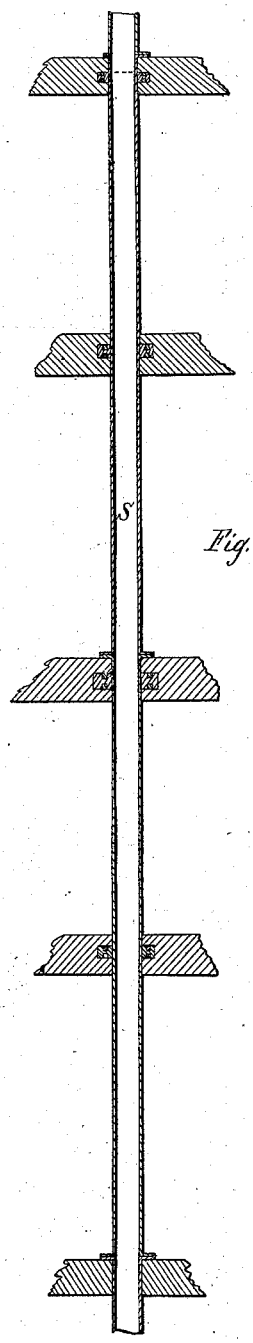
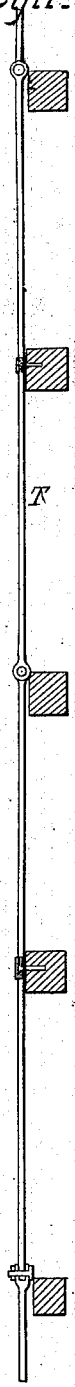


Fig. 6



Witnesses
C. F. Cattin
H. C. Dripps

Inventor
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UNITED STATES PATENT OFFICE.

THOMAS M. FELL, OF NEW YORK, N. Y.

IMPROVEMENT IN MINE-PUMPS.

Specification forming part of Letters Patent No. 47,283, dated April 18, 1865; antedated April 7, 1865.

To all whom it may concern:

Be it known that I, THOMAS MARA FELL, mining engineer, of 26 Broadway, in the city, county, and State of New York, have invented improvements in the plan of raising water, which is more especially adapted for draining mines, and which I call "Fell's Direct Action Mine Steam-Pump;" and I do hereby declare that the following is a full and complete description thereof, reference being had to the accompanying drawings and to the letters of reference marked thereon.

My invention consists in so combining specific devices with steam and pneumatic power that the effective force of steam direct for the purpose of working pumps will thereby effect a considerable saving in boiler capacity.

In order to explain the difference between my plan of direct action and the present arrangement for draining mines, I state that a Cornish pumping-engine with appurtenances consists of a set of pumps placed down the shaft of a mine at intervals of about one hundred and twenty to one hundred and fifty feet, the whole communicating with an immense beam or rod, driven by a large balance-gear, &c., propelled by corresponding powerful steam engines and boilers, the large first cost of which constitute the principal expense in starting a new mine.

The combination and arrangement for using the direct action of steam consists as follows:

Figs. 1 and 2 represent vertical longitudinal sections or front and side views; Fig. 3, plan or cross-section; Fig. 4, a general view showing the counter-weight and frame; Fig. 5, vertical section of pump; and Fig. 6, plan of pipe and lifting-rods.

A is a steam-cylinder with air-holes at the mark 2, fed by steam from a boiler, at about fifty pounds per square inch, by the supply-valve B, consisting of a circular valve of brass with a stuffing-box, C, the exhaust or waste-valve of similar construction; D, the piston; E, piston-rod; F F, valve-rods sliding in the tightening-guides G, bolted to the cylinder; H H, cross heads or bars, carrying the rods F F and valves B C; I, another cross head; K, a condensing apparatus consisting of the condenser K, a valve, L, rod M, valve-rod N, exit water-valve O, steam-pipes P, perforated disks Q, and valve R. S is the main water-pipe from the mine; T, wrought-iron chain-rod extending down the mine and attached to the piston-rod of the main pump. U is the balance-chain; V, a counter-weight; W, groove-pulleys; X, timber frames, to which the whole apparatus is fastened; Y, tappet fastened to the piston rod E; Z, the main lifting-pump, placed at any required depth and fitted with the ordinary piston and plungers, with valve and suction-pipe.

The mode of operation is as follows: The strength of material and area of pump and cylinder being proportioned or determined by the height of lift, steam of sufficient pressure—say about fifty or sixty pounds per square inch—is let into the cylinder A by the valve B on the under side of the piston D, which, being in connection with the piston-rod E and wrought-iron chain-rod T, attached to the pump below, necessarily raises the column of water to the condenser through the valve R. When the full stroke is made, the tappet Y′ closes the valve B, opens the exit-valve C and water-valve L, which allows the steam to pass into the condenser, which circulates through the pipes P and helps to raise the valve L. At the same time the mine water in the upper chamber rushes down through the perforated disks Q in a fine shower, thereby creating a vacuum by condensation. Six inches of motion is only given to open these valves. Therefore when the piston D is on the downstroke within this distance, it shuts the valve L by the arrangement of the cross sliding bars F, H, and T. It also closes the valve C, but at the same time opens the valve O, which allows the water to escape. This up-and-down motion may be indefinitely communicated by the main chain-rods to the pump below—say at five times per minute.

The weight-chain and pulley U, P, and W perform a very important office, which is as follows: When the vacuum is created in the condensing apparatus, which is always on the downstroke and by means of the exhaust-valve C, which remains open for about the space of six seconds, an atmospheric pressure due to an almost perfect vacuum acts on the piston D through the holes 2, which, together with the weight of the rods below, is very considerable for the downstroke. Now, as these rods would descend by their own

weight, it necessarily follows that the weight P can be made nearly equal to the weight of rods and effect produced by vacuum, which, added, equals nearly five thousand pounds. The full effect of this force is obtained on the upstroke, so as to raise water without any extra expenditure of steam-power. Now, as the full force of steam on the piston for a mine of—say three hundred feet—would be about one thousand four hundred pounds by this combination of condenser and counter-weight, the gain in nearly one-half of the force required. The supply and exhaust ports for passage of steam to the cylinder need not be large, as the motion is very slow.

The above apparatus is designed to drain a mine of three hundred to five hundred feet deep. The main water-pipe is seven inches in diameter, made of wrought-iron, three-eighths thick, and both this and the entire condenser with its connections are lined with earthenware, glass, or other substance capable of resisting the corrosive action of water.

When very deep mines require draining and if it is expedient, on account of strength of material being limited, I employ a second or more pumps, which are easily attached and worked by the one chain-rod of my cylinder. In this case, the weight V would be proportionally increased.

It is evident that there is but little friction to overcome, that the limit as to depth of raising water is only due to the consideration of strength of material. Cast-iron discharge-pipes of large diameter are generally used for Cornish pumps which give from ten to fifteen strokes per minute.

My wrought-iron pipe of small diameter is bolted or fastened together with flanges and supported by the timbers of the shaft. It is deemed obvious that the above plan of pump possesses several economical features.

The great saving in the use of steam and in construction, compared with the present immense contrivance termed a "Cornish pumping-engine," is believed to be in favor of my plan.

My apparatus has very little friction, and will cost but little to keep it in good order.

What I claim, and desire to secure by Letters Patent, is—

The combination of the several devices—viz., the cylinder A, connected with the main pump by the rods T, exit-pipe S, weight V, chain W, condensing apparatus K, Q, and L, and the valves B, C, R, L, and O, substantially and for the purpose as herein set forth.

THO. M. FELL.

Witnesses:
W. C. DRIPPS,
C. T. CATLIN.